Coordinated Multi-point Operation in HSPA+

JyMoRe-project

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Coordinated downlink multi-point in general

- Controlled transmission from two or more cells to one user terminal
  - Physical layer
    - User scheduling
    - Reception of signals
    - Signaling
  - Upper layers
    - Traffic and flow management
    - Signaling
Research in brief

- Studied multi-point concepts over HSDPA
  - Multiflow
  - High-Speed Single-Frequency Network (HS-SFN)
  - High-Speed Data Discontinuous Transmission (HS-DDTx)
  - Single-Frequency Network (SFN)

**JyMoRe-project**
- Research conducted together with Nokia Siemens Network
- Three Ph.D. students

**Simulation based study**
- System level simulator with accurate HSDPA modeling
- No real equipment
Multiflow

- UE is able to receive two different data blocks from two cells
- Transmissions separated by different scrambling codes
  - Dual-cell capable user equipment (UE) required (DC-HSDPA)
- Throughput improvement up to 50% in cell edges
- Multiflow standard finalised during 2012
Multiflow

Throughput gains in cell-edge areas may be improved by even 50%
High-Speed Single-Frequency Network (HS-SFN)

- Two cells transmit exactly the same data to one UE
  - SINR improvement
  - Outage reduction
- Cell edge UE throughput improved up to 20-30%
- HS-SFN useful only for small portion of users in the network
- More complexity required in terminal equipment than with Multiflow
High-Speed Data Discontinuous Transmission (HS-DDTx)

- Certain cells omit transmission in order to reduce interference
- HS-DDTx used with HS-SFN
  - Scheduler chooses the best mode in each frame
- Less than 5% throughput improvement

- Combined gains with HS-SFN and HS-DDTx up to 20-30%
Two or more cells share the same networking parameters and transmit the same signal to one UE
- SINR improvement
- Outage reduction

Less complexity in user equipment than in HS-SFN

Several limitations encountered during the study → in realistic scenario only moderate throughput improvement (<10%) was observed

Concept seems promising for further study, concerning signal reception and user scheduling
Products of the study

- Multiflow
  - One conference publication and another to be submitted
- HS-SFN and HS-DDTx
  - Three conference publications
  - One journal publication under work
  - One patent
- SFN
  - One conference publication to be submitted
  - One journal publication planned
  - One M.Sc. thesis
Ph.D. plan

- Thesis to be a collection of publications
- Currently 43 credits, 2-4 publications
  - Dissertation 2013

